5. ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. See Table 2-1 in Section 2.0 Alternatives, for summary of impacts. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects.

5.1. GENERAL ENVIRONMENTAL EFFECTS

5.2. VEGETATION

Vegetative species within the study area are site specific and it is highly probable that there will be effects to plant communities due to the Preferred Alternative and other alternatives. These effects are expected to be largely beneficial, but in certain areas may be locally detrimental due to Lake Okeechobee's existing water quality.

5.2.1. LAKE OKEECHOBEE

RECOVER (Restoration Coordination and Verification) is an arm of the Comprehensive Plan (CERP) responsible for linking science and the tools of science to a set of system-wide planning, evaluation and assessment tasks. The most current (as of March 2006) RECOVER performance measures for Lake Okeechobee extreme low lake stage (<10 feet), Lake Okeechobee extreme high lake stage (>17 feet), and Lake Okeechobee stage envelope (within [%], above [SS], below [SS]) were utilized to evaluate the alternatives of the LORSS effort. In-depth documentation and rationale for these performance measures is available through the RECOVER performance measure documentation and is available for review in the draft RECOVER Comprehensive Everglades Restoration Plan System-wide Performance Measures report (RECOVER, 2006), at the following web address:
www.evergladesplan.org/pm/recover/eval_team_perf_measures.cfm.

High Lake Stage

As stated throughout this document, all the alternatives lower the top stage of the schedule from 18.5 feet (WSE) to 17.25 feet. All alternatives would produce lower lake stages and fewer occurrences of prolonged high and extreme high lake stage events.

At the extreme high stage (>17 feet), it has been documented that wind driven waves can cause large-scale loss of submerged and emergent plants by physical uprooting (Havens et al., 2004c). Reduction in the duration and severity of high water stages is expected to be more favorable for maintenance of more diverse vegetative communities in the littoral zone, which in turn should provide for more favorable habitat conditions for fish and wildlife. The anticipated overall increase in diversity of littoral vegetation is expected to include larger areas vegetated by willow, which has been adversely impacted through the years by prolonged high water elevations. Willow is important nesting substrate for wading birds and the endangered snail kite. More extreme high water stages >17 feet would be significantly reduced under 1bS2-m, or any of the alternatives, compared to WSE, thereby decreasing the likelihood of erosion

of bulrush from the deep water edge of the littoral zone, and encouraging healthy growth and vegetative recruitment.

Even prolonged periods of moderately high lake levels are known to impact marsh vegetation. When lake stages exceed 15 feet for long periods, especially when light penetration is inhibited by turbid water, adverse impacts to SAV can occur. The percent of time in the simulation when lake stages exceed 15 feet would decrease from approximately 31 percent under WSE to about 16 percent under the Preferred Alternative, 1bS2-m. Modeling simulations indicated that the base had two events of lake stage >15 feet for 365 days. All other alternatives have zero events. As the past has shown, even moderate high lake levels (>15 feet) of prolonged (>12 months) duration, may cause significant harm to the lake's ecosystem. All of the alternatives did equally well with reducing lake stages >17 feet. The base performed the worst for this PM.

Low Lake Stage

The extreme low stage PM used in this study identifies a critical stage of 10 feet, a depth at which substantial adverse effects on the lake may occur. It is at this depth where detailed field observations during the 2000-2001 drought indicated that adverse effects such as rapid spread of terrestrial weedy plants, severe loss of SAV, loss of apple snail population, occurred. Even when the lake stage falls below 11 feet, the entire littoral zone is dry (Havens and Gawlik, 2005). However, there are a number of benefits to the ecosystem that occur at low levels, such as drying and oxidation of accumulated organic detritus in the littoral zone, favorable conditions for marsh fires that burn away cattail and torpedograss thatch, and exposure of moist soil for plant germination (Havens et al., 2004c).

As would be expected, alternatives that did the best in reducing extreme high lake stage occurrences did worse on reducing extreme low lake stage occurrences. The base, however, has fewer low lake stage events than the other alternatives, as would be expected since it has more high lake stage events. The remainder of the alternatives scored relatively the same for lake stages <10 feet. All of the alternatives will have more low stage events compared to the base. Alternative 2a-m performed the worst with number of days the lake stage is <10 feet. However, the positive ecological effect of these alternatives lowering the lake stage to reduce the high extreme events potentially out weights the possible adverse ecological effects of occasional extreme low water events.

Stage Envelope

Although the stage envelope is optimal for the lake, it is also necessary for the system to occasionally experience the extreme highs, and particularly the extreme lows, which would mimic more natural conditions. In Lake Okeechobee, water level management that mimics natural conditions will have the greatest benefits to plant communities (FFWCC, 2003).

A water management regime similar to the Lake Okeechobee Stage Envelope PM, where water levels are between 12.5 feet (June-July low) and 15.5 feet (November-January high), is the target range for the preferred Alternative, 1bS2-m. A wide body of published research documents the benefits of variable water levels within this range (Havens & Gawlick, 2005; FFWCC, 2003; Smith, et al., 1995; Aumen and Gray, 1995). A January to June stage recession would provide benefits for wading birds nesting and foraging, development of good submerged and emergent vegetation habitat for fish and wildlife, and in general, benefits the littoral wetland by providing a range of water depths that subject most of that area to wetting and drying (Havens et al, 2003c). Although these conditions are beneficial, they should not be repeated every year. Lake Okeechobee experts recognize that there also should be years of extreme stage, especially stages below 11 feet that are needed to periodically dry out lower elevation littoral areas so they can benefit from detritus oxidation and fires (Aumen and Gray, 1995; Havens et al., 2004c).

All alternatives performed basically the same for the percentage of time within the stage envelope. The differences within the stage envelope were minor with Alternative 1bS2 falling within the stage envelope 27.3 percent of the time and Alternative 2a falling within the envelope 32 percent of the time (Figure 5-1). The remaining alternatives fell somewhere in between these scores

Figure 5.1

Due to the small differences in the performance of the alternatives based on modeling simulations, it is unclear whether one alternative is significantly better for lake vegetation or lake ecology in general. The differences are indistinguishable from each other in their potential ecological effect.

5.2.2. ESTUARINE VEGETATION

The PMs used to evaluate the impacts to the St. Lucie and Caloosahatchee estuaries, and the results of the evaluation can be found in Section 5.5.2, and are not repeated in this section. The discussion of impacts on vegetation can be found below.

St. Lucie Estuary

The natural shoreline and inter-tidal areas of the estuary were once populated by mangroves and other detritus producing vegetation, but now due to shoreline alterations supports very little vegetation. In many areas, seawalls and docks have replaced mangroves and seagrasses. Large volumes of freshwater basin and Lake Okeechobee releases have caused SAV to virtually disappear from the St. Lucie Estuary as well as some areas of the IRL South closest to the St. Lucie Estuary (USACE, 2004). Most SAV coverage in the St. Lucie Estuary is now found near the IRL. Those species known to occur there are shoal grass (*Halodule wrightii*), wigeongrass (*Ruppia maritime*), and Johnson's seagrass (*Halophila johnsonii*). Maintaining the correct salinity in the estuary would provide benefits for these aquatic plants requiring specific

salinity ranges. Light availability is also an important factor for SAV colonization. The depth to which the required quantity of light may penetrate the water is inversely proportional to turbidity and water color. Other water quality parameters that affect light attenuation include nitrogen and phosphorus. Increasing water clarity and stabilizing the salinity regime in the estuary would increase light penetration and expand the area of suitable habitat for aquatic plant colonization.

Alternatives 1bS2, 1bS2-m and 4, all improve the overall performance for the St. Lucie Estuary. These three alternatives show similar results, but Alternative 1bS2-m performs somewhat better than the others in reducing flows >2000 cfs (Figure 5-2). Alternative 1bS2-m had the fewest (65) mean monthly flows >2000 cfs. That translates to approximately nine less events (compared to WSE) over the 36 year POR where the estuary suffers from flows >2000 cfs. To the extent that the Preferred Alternative, 1bS2-m, is able to reduce damaging regulatory discharges to the estuary and IRL system, it will benefit SAV, including seagrasses which are currently in a declining state from sediment and nutrient deposition from upstream sources. Clearer water and more stable salinity are expected to foster re-colonization of the bottom by benthic plants, especially shoal grass.

Minimizing flows >2000 cfs would provide a salinity range more favorable to SAV. However, Alternatives 2a and 2a-m do not reduce damaging flows >2000 cfs to the estuary. Alternatives 2a and 2a-m performed similar to the base, WSE, regarding mean monthly flows >2000 cfs. The base and Alternative 2a had 74 events, whereas Alternative 2a-m had 73. As such, these alternatives would not provide improvements in flow ranges >2000 cfs, or provide more suitable conditions for SAV re-colonization.

Figure 5.2

Caloosahatchee Estuary

At times, the Caloosahatchee receives high volume inflows during the wet season. During the dry season inflows may be too low and supplemental input from Lake Okeechobee is required to maintain a viable salinity gradient in the estuary. Mean monthly flows >2800 cfs may cause mortality of marine seagrasses and other organisms near the mouth of the Caloosahatchee Estuary. Mean monthly flows >4500 cfs may begin to cause mortality of seagrasses in the adjacent San Carlos Bay.

Performance for the Caloosahatchee Estuary is somewhat mixed. All of the alternatives did better than the base at maintaining the preferred flows between 450 to 2800 cfs. Additionally, all of the alternatives did better than the base at reducing the number of large volume flows between 2800 and 4500 cfs. However, none of the alternatives did better than the base, WSE, at reducing large volume flows >4500 cfs (Figure 5-3). Only Alternative 2a-m did a better job at reducing durations of flows >4500 for >5 weeks.

Figure 5.3

All of the alternatives, except the No Action Alternative, would provide environmental base flow releases to the Caloosahatchee Estuary. This feature was included to address the dry season inflows that may be too low to maintain a viable salinity gradient in the estuary. During times of extended low inflow conditions, when salinity is too high in the upper estuary, tape grass (Vallisneria americana), which is a salt tolerant, fresh water species, becomes very sparse and can disappear completely (Doering et al., 2002). When growing conditions are favorable, the most extensive beds are found in the 640 acre area between Beautiful Island and the Ft. Myers Bridge.

5.2.3. EVERGLADES AGRICULTURE AREA

Under any of the alternatives, regulatory discharges from Lake Okeechobee will be confined to existing canal systems and flow through the EAA without impacting existing vegetation. Furthermore, native vegetation, within remnant wetlands and within the Rotenberger and Holey Land WMAs will not be impacted.

5.2.4. WATER CONSERVATION AREAS (GREATER EVERGLADES)

For simplicity, the impacts to the greater Everglades as they relate to vegetation (Section 5.2) and fish and wildlife resources (Section 5.5) are discussed completely in this Section, 5.2.

Indicator Regions (Figure 5- 4) representing a variety of habitat types in the Everglades were used to evaluate the alternatives. A subset of the total number of Indicator Regions was selected to represent the range of hydrologic conditions in the WCAs, northern dry areas, southern wet areas, and several middle regions. The Indicator Regions used for the WCAs were 100, 102, 110, 113, 115, 121, 124, 125, and 128, and for northern Shark River Slough 129. The Indicator Regions used for snail kites were 101, 112, 115, 117, 118, and 119.

Figure 5.4

A subset of Hydrologic PMs was used in these analyses to evaluate impacts of the Alternatives on the Everglades. Only hydrologic conditions, not water quality, were evaluated. These hydrologic PMs were peat dry-out, tree island inundation, wading bird breeding season water recession rates and reversals, and snail kite breeding and apple snail reproduction.

Peat dry-out, total weeks: Evaluation is based upon the number of weeks that water depths fell below one foot or lower below the surface. Peat dry-out increases the frequency and severity of peat fires, which can severely damage wetland ecosystems. The target is to reduce the weeks of very low water tables. Lower numbers are preferred. All of the alternatives increase the number of weeks of peat dry-out.

Figure 5.5

Wading Bird Nesting Success: Wading birds nest from January through May in the Everglades. The two PMs that target wading birds are recession rates and reversals. Recession rates describe the declines in water depths, and reversals are defined as rapid increases in water depths.

Recessions: As water depths decline in the dry season, wading bird food species are concentrated in the shallower water, increasing the wading birds' feeding efficiency. Optimal water depths for wading birds vary with the species, and move across the landscape as water depths decrease. The concentrated prey allows the parent birds to feed their hatchlings and to successfully fledge the year's young. The months that are important for this PM are January through May each year.

Target recession rates are -0.1 foot per week. This measure reports the number of weeks that recession rates fall into the "good" category (declining water depths between 0.16 and 0.05 feet per week). The goal is to increase the percent of weekly recession rates falling into the "good" category during the wading bird breeding season. Higher numbers are better. The Alternatives are ecologically similar.

Figure 5.6

Reversals: When water depths increase during the breeding bird season (January through May), food prey concentrated in shallower pools disperse, reducing feeding efficiencies of the parent birds. Reduction in feeding reduces nesting success of wading birds, so reversals should be avoided during this period of the year. This PM summarizes the percent of weeks of reversals (when recession rates are above the desired recession rates and increasing). Lower numbers are better. For this PM, reversals are similar for all alternatives.

Figure 5.7

Tree island inundation: Tree species on tree islands are adapted to a period of inundation. However, excessive periods of long-term inundation can reduce the survival of tree species when one year, or a succession of years, exceed the tree species tolerances. The Tree Island Inundation PM records the duration, in weeks, of water depths above two and a half feet. The preferred number of weeks should not exceed 17 per year. Although the total number of weeks (events * duration) varies, none of these differences is significant.

Figure 5.8

Greater Everglades Snail Kite: Like the wading birds, snail kites also reproduce during the early part of the year and feed upon apple snails. Rapid water depth reversals are harmful to apple snail reproduction, and loss of a year's cohort of apple snail eggs impacts snail populations for two to three years. Lack of prey inhibits snail kite reproduction and survival and therefore conditions that decrease apple snail populations negatively impact snail kites.

The PM for the snail kites indicates "Optimal" (O) conditions, "Marginal" (M) conditions, and "Unsustainable" (U) for snail kites. For the select Indicator Regions, ratings of "Unsustainable" were valued at 0, "Marginal" at 5, and "Optimal" at 10. These values are summed over the selected Indicator Regions. All the alternatives except for 2a-m are better than the current schedule.

Figure 5.9

5.3. THREATENED AND ENDANGERED SPECIES

Formal consultation in accordance with the Endangered Species Act (ESA) included submittal of a Biological Assessment on June 30, 2006. Additional information on ESA consultation is found in Appendix C.

5.3.1. EVERGLADE SNAIL KITE

No Action Alternative or Base (WSE)

The issue of high water levels and the detrimental effects on the littoral zone of Lake Okeechobee has been a major concern since the 1990's, and a major focus of the LORSS. The littoral zone of Lake Okeechobee provides one of the largest habitats in south Florida for the snail kite (Bennetts and Kitchens, 1997) and it supports large populations of wading birds (Smith et al., 1995). High water effects result in declines of submerged plants, as well as loss of bulrush and other emergent vegetation, where apple snails (main food source for the snail kite) lay their eggs.

Under the No Action Alternative, during abnormally wet periods of heavy rainfall and runoff, Lake Okeechobee would continue to experience high stages >16 feet, NGVD, and extreme high lake stages >17 feet, NGVD. During periods of extreme high lake levels (>17 feet), wind and erosion cause emergent and submerged plants to be torn loose from their substrate, resulting in a loss of important fish and wildlife habitat When compared to the other alternatives, WSE ranks the worst for high lake stage events, and is the only alternative with prolonged periods of moderately high lake stages (>15 feet for 365 days). Prolonged inundation of the littoral zone by stages >15 feet under the WSE schedule reduces diversity of marsh vegetation on which that species depends. This alternative would continue to allow high lake stages which could adversely affect the Everglade snail kite.

Alternatives 1bS2 and 1bS2-m

All of the alternatives perform basically the same for percent of time within the stage envelope of 12.5 feet (June-July low) and 15.5 feet (November –January high). A wide body of published research documents the benefits of seasonally variable water levels within this range for the benefit of many plants and animal communities on Lake Okeechobee. Habitat for the snail kite is expected to improve with a water management regime that mimics more natural hydrologic variability. Both alternatives 1bS2 and 1bS2-m are designed to manage the lake at lower elevations. However, while both alternatives produce comparable benefits for the lake's littoral zone, 1bS2 allows the lake stage to exceed >16 ft., NGVD, more often (approximately 150 days more over the 36-year simulated POR) than Alternative 1bS2-m.

According to Bennetts and Kitchens (1997), snail kites nest primarily in willow and other woody vegetation types. Two factors contributing to loss of this habitat in Lake Okeechobee include prolonged periods of deep water and the expansion of exotic vegetation such as torpedograss. Torpedograss expansion is more likely during extreme low water periods. Both alternatives perform well for reducing high lake stages and limiting extreme low lake stages. Extreme low lake stage is defined by the technical experts to be a depth below 10 feet. It is at this level that detailed field observations during the 2000-2001 drought indicated that negative effects (rapid spread of terrestrial weedy plants, loss of nearly all the submerged vegetation habitat, loss of the lake's apple snail population) occurred. The modeling results of Alternatives 1bS2 and 1bS2-m indicate that lake levels below 10 feet occurred approximately four percent of the time during the 36 year POR. The positive effect of these two alternatives lowering the lake

stage to reduce the high extreme events clearly outweighs the potential negative effect of occasional extreme low water events. Either alternative may affect the snail kite and its critical habitat. Even though the extreme lows may be adverse, it is expected that the effects overall from these two alternatives would be beneficial to the species.

Alternatives 2a and 2a-m

All of the alternatives were developed to reduce the frequency of high lake stages on Lake Okeechobee. Alternatives 2a and 2a-m perform slightly better than 1bS2, 1bS2-m and 4 for reducing high lake stages above 16 ft., NGVD. However, all of the alternatives perform nearly the same for the percent of time inside the stage envelope. The only discernable difference for lake performance with these two alternatives is their performance for extreme low lake stages <10 feet. Compared to all alternatives, including the No Action, Alternatives 2a and 2a-m performed slightly worse. The effects of 2a and 2a-m would be relatively the same as those effects described for Alternatives 1bS2 and 1bS2-m. However, it is expected that the negative effects from increased extreme low water events would be more substantial from Alternatives 2a and 2a-m. These extreme low conditions could impact nesting and foraging habitat for the snail kite. Macro-invertebrates such as the apple snail are impacted by extreme low water levels due to effects on plant habitat. A prolonged period of extreme low stage in 2000-2001 appeared to have nearly eliminated the apple snail population from the littoral zone. Alternatives 2a and 2a-m may have some negative effects to the snail kite and its critical habitat due to extreme low lake stage occurrences however, it is expected that the overall effects would be beneficial to the species. The occurrences of extreme low levels may directly impact the apple snail.

Alternative 4

Alternative 4 would provide some of the same hydrologic improvements and have similar effects on the snail kite as Alternatives 1bS2, 1bS2-m, 2a and 2a-m. Alternative 4 is comparable to the other alternatives for reducing high lake stages, and for the percent of time in the stage envelope. However, Alternative 4 has less extreme low events than 2a or 2a-m. Alternative 4 compares to 1bS2 and 1bS2-m for percent of time below 10 feet. As such, the effects as described above for IbS2, 1bS2-m, 2a and 2a-m would apply to Alternative 4. Alternative 4 may have some negative effects on the snail kite and its critical habitat due to low lake stage occurrences; however, it is expected that the overall effects would be beneficial to the species.

5.3.2. WOOD STORK

The description above for the snail kite, favors littoral zone/marsh communities supported by wading birds. The quality of foraging habitat within Lake Okeechobee is expected to improve as a result of lower lake levels and a more natural hydrologic variability (moderately declining water levels during the wading bird nesting season) achieved by all alternatives compared to the base. Alternatives 1bS2, 1bS2-m, 2a, 2a-m, and 4 may affect the wood stork, but beneficial effects would be expected for this species. The No Action Alternative would continue to allow high lake levels, adversely impacting Lake Okeechobee's littoral zone that the wood stork utilizes.

5.3.3. WEST INDIAN MANATEE

As described above for the snail kite, all alternatives, except the base, would be beneficial for Lake Okeechobee's littoral zone plant and animal communities. All alternatives, except the base, would reduce the frequency of high water levels that have been detrimental over the years to the lake's resources. If littoral zone improvements are achieved, then there is the potential for an increase in the vegetative community on which the manatee feeds. There would be no significant adverse effect on habitat conditions for the manatee within the lake as a result of any of the alternatives.

5.3.4. BALD EAGLE

The potential improvement to conditions of Lake Okeechobee's littoral zone may result in enhanced productivity of fish in the lake. Foraging conditions may be slightly improved for the eagle for all alternatives compared to the base. It is determined that implementation of either alternative would have no effect on the bald eagle.

5.3.5. EASTERN INDIGO SNAKE

The Eastern indigo snake occurs primarily on uplands. Implementation of any of the alternatives, including the base, would not affect the indigo snake.

5.3.6. CAPE SABLE SEASIDE SPARROW

The modeling simulations indicate that the hydrology of the indicator regions of the Everglades corresponding to occupied CSSS habitat is not adversely affected by the base or Alternatives 1bS2 or 1bS2-m. Therefore, neither the species nor its designated critical habitat would likely be affected by these alternatives. Modeling simulations for Alternatives 2a, 2a-m, and 4 performed slightly worse as these alternatives indicated a flow decrease to the ENP by -6,000 acre ft./year, -13,000 acre ft./year, and -10,000 acre ft./year, respectively.

5.3.7. OKEECHOBEE GOURD

The Okeechobee gourd would benefit from any of the alternatives, except the base, as all of the alternatives lower the high lake stages. By decreasing the high stage events, the alternatives would allow for more low lake stage events. As such, there would be a potential benefit to listed species, such as the Okeechobee gourd, where a lower lake stage is crucial for its survival. Low lake stages allow for suitable habitat areas within the littoral zone that are able to dry out and allow for seed germination. Implementation of the Preferred Alternative or any of the described alternatives may effect the gourd, however, the reduction of extreme high water under these alternatives should benefit this species overall.

5.3.8. SMALLTOOTH SAWFISH

Since the Florida smalltooth sawfish population is currently restricted to waters of southwest Florida, especially along the coastal fringe of ENP and north to Charlotte Harbor, releases from Lake Okeechobee to the St. Lucie Estuary will not affect this species. It would be more common for the smalltooth sawfish to be found along the coastal areas of the Caloosahatchee Estuary, or near the mouth of the Calooshatchee River. Some research and monitoring in the Charlotte Harbor estuarine system is currently being conducted by the FFWCC. In studies documenting occurrences of sawfish along the southwest coast of Florida, anglers have reported encountering sawfish on a regular basis in the Charlotte Harbor area, and near the mouth of the Caloosahatchee River (Seitz and Poulakis, 2002). As part of the Charlotte Harbor study, the FFWCC is currently conducting monthly random sampling for sawfish in the Caloosahatchee River (FFWCC, 2005).

It has been documented that juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests and SAV, as important nursery areas. A more stable salinity regime may result in increased SAV coverage, and therefore increase the population of small fish and benthic organisms, which are a food source for the sawfish.

As discussed in Sections 5.2.2 and 5.5.2, performance for the Caloosahatchee Estuary is somewhat mixed. All of the alternatives did better than the base at maintaining the preferred flows between 450 to 2800 cfs. Additionally, all of the alternatives did better than the base at reducing the number of damaging flows between 2800 and 4500 cfs. However, none of the alternatives did better than the base, WSE, at reducing high damaging flows >4500 cfs. Only Alternative 2a-m did a better job at reducing durations of flows >4500 for >5 weeks.

Implementation of the Preferred Alternative (1bS2-m) is likely to increase the preferred flow range between 450 to 2800 cfs, and reduce damaging flows between 2800 and 4500 cfs. Even though damaging flows above 4500 cfs may increase (three months over the 36 year POR), it is not a substantial difference over the current WSE schedule. The preferred regulation schedule (1bS2-m) is not likely to directly affect the sawfish. However, there is the potential for indirect effects to the habitat (i.e. seagrasses) that the sawfish occupies at the mouth of the Caloosahatchee River when releases are greater than 4500 cfs, for long durations. The Corps has determined that the proposed alternative regulation schedule “may affect” but is not likely to adversely affect the sawfish.

5.3.9. JOHNSON’S SEAGRASS

One of the objectives of this study is to reduce high regulatory releases to the St. Lucie Estuary, and thereby improve the salinity regime to the area. Modeling results indicate that Alternatives 2a and 2a-m decrease mean monthly flows between 2000 cfs and 3000 cfs, but do not decrease damaging flows >3000 cfs. Results indicate that Alternatives 1bS2, 1bS2-m (Preferred Alternative) and 4, all decrease the mean monthly flows >2000 cfs to the St. Lucie Estuary. The decreased freshwater discharges from the Lake would cause less stress to seagrasses, including Johnson’s seagrass, in the IRL. As such, the Corps has determined that the preferred Alternative, 1bS2-m, is not likely to adversely affect Johnson’s seagrass.

5.3.10. STATE LISTED SPECIES

Of the State listed species not evaluated above, the American alligator, brown pelican, and black skimmer (species of special concern) may slightly benefit from the preferred Alternative, 1bS2-m by the improved fish production in Lake Okeechobee, which those species consume. The wading birds, roseate spoonbill, limpkin, little blue heron, reddish egret, snowy egret, tricolored heron, and white ibis, may benefit by the improved spring water recession regime under 1bS2-m.

5.4. HARDGROUNDS

Hardgrounds would not be affected by any of the alternatives.

5.5. FISH AND WILDLIFE RESOURCES

As was the case with vegetation (Section 4.2), the study area is site specific with regard to fish and wildlife resources and it is highly probable that there will be affects on these resources due to the recommended alternative, or any other alternative discussed. These effects are expected to be largely beneficial, but in certain areas may be locally adverse due to the lake’s existing water quality problem.

5.5.1. LAKE OKEECHOBEE

Although the pelagic zone of Lake Okeechobee is important in supporting commercial and recreational fisheries, the littoral zone of the lake is highly productive, sustains a greater diversity of fish and wildlife, and is the area most affected by changes to the lake's regulations schedule. Lake Okeechobee's littoral zone provides critical habitat for fish and wildlife, including Federal listed species as described in Section 3. A general understanding of how fish and wildlife respond to changes in habitat structure and resource availability leads to a consensus among experts that Lake Okeechobee's fish and wildlife may be harmed by extreme high and low stage events (Havens et al., 2004c; FFWCC, 2003).

These extreme water levels can completely dry out or inundate Lake Okeechobee's entire littoral zone. However the issue of high water levels and the detrimental effects on the ecology of Lake Okeechobee has been a major concern since the 1990's, and a major focus of the LORSS. Scientists observed a large-scale loss of aquatic vegetation and impacts to fisheries in Lake Okeechobee when high water conditions persisted from 1995 to 1999 (Havens, et al., 2001). Greater water depths have devastated woody plants, and submerged and emergent macrophytes, resulting in habitat destruction and alteration of primary production in the Lake Okeechobee ecosystem (FFWCC, 2003).

In Lake Okeechobee, water level management that mimics natural conditions will have the greatest benefits to plant communities (FFWCC, 2003). The water management regime would be similar to the Lake Okeechobee Stage Envelope PM (LO-3), 12.5 feet (June-July low) and 15.5 feet (November-January high). The ideal pattern for foraging by wading birds is considered to be an uninterrupted decline in lake stage from approximately 15 feet in January to approximately 12 feet by June without reversals (rising water stages) of >0.5 feet (USFWS, 1999). This type of spring recession would not only provide benefits for wading birds nesting and foraging, but would also provide development of good submerged and emergent vegetation habitat for fish and wildlife, and in general, benefits the littoral wetland by providing a range of water depths that subject most of that area to wetting and drying (Havens et al, 2003c).

As stated throughout this document, all the alternatives lower the top stage of the schedule from 18.5 feet (WSE) to 17.25 feet. All alternatives would produce lower lake stages and fewer occurrences of prolonged high and extreme high lake stage events. There is no observable difference in higher stages among the alternatives. In addition, all alternatives performed basically the same for the percentage of time within the stage envelope. The differences within the stage envelope were minor with Alternative 1bS2 falling within the stage envelope 27.3 percent of the time and Alternative 2a falling within the envelope 32 percent of the time. The remaining alternatives fell somewhere in between these scores. All alternatives minimized prolonged duration of high stages except for the base, WSE. Modeling simulations indicated that the base had two events of lake stage >15 feet for 365 days. All other alternatives had zero events. All of the alternatives did equally well with reducing lake stages >17 feet. The base performed the worst for this PM.

The base, however, has fewer low lake stage events than the other alternatives, as would be expected since it has more high lake stage events. The remainder of the alternatives scored relatively the same for lake stage occurrences <10 feet. However, Alternative 2a-m performed slightly worse than any other alternatives. All of the alternatives will have more low stage events compared to the base. However, the

positive effect of these alternatives lowering the lake stage to reduce the high extreme events clearly outweighs the potential negative effect of occasional extreme low water events. Lake Okeechobee can benefit from low level occurrences, but the key for benefits is based on duration. Extended periods of low lake stages may have more adverse effects to fish and wildlife.

Maintaining the heterogeneous native plant communities which are intrinsic to a healthy lake littoral zone may also facilitate an improvement in fish stocks and wading birds under conditions brought about by the Preferred Alternative, 1bS2-m, or any other alternative compared to the base. By improving lake hydroperiods, including a lowering of overall lake stages and reductions in both prolonged high and extreme high lake stages, conditions for both emergent and SAV, as well as for wading bird foraging, nesting and spawning and feeding habitat for fish should be improved. When low-to-moderate water levels occur in Lake Okeechobee, resulting in dense plants such as bulrush and peppergrass, the biomass and taxonomic diversity of macro-invertebrates is maximal (Warren and Vogel, 1991). Many of these animals, including grass shrimp, amphipods, and a variety of larvae are integral to the diets of largemouth bass, black crappie, redear sunfish, and bluegill sunfish (Havens and Gawlick, 2005).

Lake stages, as predicted by stage hydrographs, will differ substantially between the Preferred Alternative and WSE. A key difference between the No Action (WSE) Alternative and the proposed action (1bS2-m) is the lake regulation schedule elevation below which no regulatory discharges are made (line between zones D and E for WSE, and the operational band No Flow for 1bS2-m (reference Figure 3-1). For WSE, the low end of the regulation schedule allows Lake Okeechobee to recede to 13.5 ft., NGVD. Under Alternative 1bS2-m, the low end of the regulation schedule is at 11.5 ft., NGVD. The proposed action therefore allows for more frequent lower lake levels than would occur under WSE. Periodic dry downs have been shown to be important for the marsh and littoral plant communities to regenerate, providing optimal habitat for fish and wildlife, enhancing foraging conditions for wading birds and reducing nutrient and sediment influxes into the littoral zone from the open waters of Lake Okeechobee. However, during extended extreme low stages, there are many negative effects on wetland fauna. Bulrush stands become too dry for fish spawning or shelter, and smaller fish may face mortality due to predation in Lake Okeechobee's open waters. Wading birds and waterfowl have restricted foraging and nesting habitat. Wetland dependent organisms including turtles, frogs, snakes, marsh rabbits, muskrats, and others may suffer population declines. Extreme low lake levels with durations of three months or longer may impact the productivity of the apple snail, the snail kite's main food source.

There should be minimal adverse effects on lake fish and wildlife, including macro-invertebrates, upon which wading birds and fishes depend for food, as a result of the preferred Alternative, 1bS2-m, or Alternatives 1bS2 and 4. Alternatives 2a and 2a-m as modeled would result in some adverse effects to the lake's fish and wildlife, as described above. Adverse effects are based on more occurrences of extreme low lake levels, compared to the other alternatives.

Water levels in the rim canal or principal navigation canals should not be significantly affected during low water occurrences, and will continue to offer refuge to animals such as manatees, alligators, turtles and predator fish known to use this habitat.

5.5.2. NORTHERN ESTUARIES

Water that needs to be released from Lake Okeechobee for flood protection is termed a "regulatory release" and although these releases can go south to the Everglades or east and west to the estuaries, the largest volume goes to the estuaries. During the dry season (mid-November to mid-May) large regulatory flows are minimal to the estuaries. Higher volumes of flows to the estuaries generally occur during the wet season.

To evaluate the various alternatives, three PMs were examined: The number of mean monthly flows in various flow ranges over the 36 year POR (POR equates to 432 months), a duration measure based on the weekly moving average discharge at S-79 for the Caloosahatchee; and the two-week moving average total discharge to the St. Lucie; and finally the number of mean monthly flows in various flow ranges during the critical spring spawning period.

Spring is an important period in the Caloosahatchee and St. Lucie estuaries as many biotic groups often begin to increase their productivity and dependency on the estuary. An indicator species used during this critical time is the American oyster (*Crassostrea virginica*). Adult oysters are bottom dwellers. However, their life cycle starts in the water column. Adults release (spawn) eggs and sperm into the water column. Once eggs are fertilized a two to three week larval period begins. The larval period occurs entirely in the water column and culminates in settlement on the bottom. It is during the spring time that freshwater flows to the estuaries should be monitored closely and possibly reduced, so larvae are retained in the system and not flushed out by excessive freshwater flows. Freshwater releases should also be monitored to allow for appropriate salinity conditions for oyster reproduction. Optimal salinity for spawning is 10-30 parts per thousand (ppt) (Mazzotti, et al. 2003).

Oysters are commonly used as an indication of spawning season, but many other species of saltwater fish begin spawning in late winter/early spring. Without optimum salinity, because of excessive freshwater, other fish species may be affected too by fresh water releases.

Performance Measures

In the tables below, a color scheme has been used to indicate the relative performance of the alternatives (green identifies the best performer). The discussion of each estuary present results for each PM.

It is important to note that the hydrologic model output assumes maximum practicable releases from the Lake within each decision tree band, with consideration of downstream operational constraints. This provides a very useful means for comparing the effects of all alternatives. However, the decision making process to determine quantity, timing, and duration of the potential release considers estuary conditions/needs, potential impacts from lake releases, local runoff, and dry weather conditions. Although modeled and represented in the modeling output, maximum releases are not always necessary or recommended.

High discharges of freshwater from Lake Okeechobee can adversely affect the St. Lucie Estuary. During dry periods, supplemental water from Lake Okeechobee is generally not required. Ground water inflow and runoff from other basins supply a sufficient base flow to the estuary. Mean monthly flows >2000 cfs may lower salinity in the St. Lucie Estuary sufficiently and may cause mortality of oysters and other estuarine organisms. Flows >3000 cfs may cause significant mortality of these organisma in both the estuary and adjacent IRL. The longer these high flows last in either estuary, the higher the potential for adverse effects. So, in general, those alternatives with fewer high discharges of shorter duration are preferred.

At times, the Caloosahatchee may receive high volume inflows of freshwater from Lake Okeechobee during the wet season. During the dry season inflows are too low and supplemental input from Lake Okeechobee is required to maintain a viable salinity gradient in the estuary. Mean monthly flows >2800 cfs may cause mortality of marine seagrasses and other organisms near the mouth of the Caloosahatchee Estuary. Mean monthly flows >4500 cfs may begin to cause mortality of seagrasses in the adjacent San Carlos Bay.

During the dry season, salt water from the Gulf of Mexico can intrude up the estuary to the Franklin Lock and Dam (S-79). Too much salt in the upper estuary may adversely impact the brackish water organisms that normally inhabit this region. During the driest times, a mean monthly flow of 450 cfs at S-79 is required to maintain viable salinity conditions in the upper estuary.

Spring time is a critical period in estuarine systems because many estuarine dependent organisms reproduce at this time. High flows >2800 cfs in the Caloosahatchee and >2000 cfs in the St. Lucie, may prevent the early life stages of fish, shellfish and other commercially and recreationally important species from utilizing estuarine habitat. Alternatives with the fewest number of mean monthly flows exceeding these limits are to be preferred.

St. Lucie Estuary

Mean Monthly Total Inflow: The Preferred Alternative, 1bS2-M, had the fewest (65) mean monthly flows >2000 cfs and therefore is preferred over the other alternatives. The difference in the distribution of high flows between those >3000 cfs and those between 2000 and 3000 cfs was not large enough to distinguish one from the other. Alternative 4 had (67 events) and Alternative 1bS2 had (68 events) which are rated second and third respectively, although the difference between them was minimal. Having fewer flows >3000 cfs, Alternative 1bS2 had 26 events and therefore would be expected to do relatively less damage to the IRL. On the other hand, Alternative 1bS2 would be expected to do relatively more damage to the St. Lucie Estuary because it had more (42 events) flows in the 2000 – 3000 cfs range than Alternative 4 which had 37.

Table 5.1

Duration: Alternative 1bS2 had the fewest occurrences of 14-day moving average flows exceeding 3000 cfs for more than a month (two week periods, Table 5-2). At no time did the flow exceed 3000 cfs for more than ten weeks (five two-week periods). The No Action (WSE) Alternative ranked second. In general the remaining alternatives performed somewhat worse with occurrence of high flows for over ten weeks (five two-week periods). Alternative 1bS2-M had fewer occurrences of 14-day moving average flows exceeding 3000 cfs for more than a month than WSE, but eight of these lasted for more than 10 weeks. By contrast Alternative 2a-M had no high flows exceeding 3000 cfs for more than ten weeks but rated poorly because of a relatively high number that lasted for more than a month (46).

Table 5.2

Critical Period: Based on mean monthly flows >2000 cfs, Alternatives 4 and 1bS2-M tied for best performance with 17. Alternative 1bS2 was ranked next best with 18 (Table 5-3).

Table 5.3

Caloosahatchee Estuary

Mean Monthly Flows: With respect to high flows, no alternative out performed the No Action Alternative (WSE). The No Action Alternative had 34 occurrences of high flows >4500, whereas Alternative 1bS2 ranked second with 36 occurrences, and Alternatives 1bS2-m, 2a-m and 4 with 37 occurrences each (Table 5-4). With respect to high flows between 2800 and 4500 cfs, all the alternatives showed improvements over the base, WSE. Alternatives 2a-m and 4 ranked best in this flow range.

Table 5.4

Duration: Alternatives No Action and Alternative 2a-m performed the best with respect to duration of high flows (Table 5-5). While the No Action Alternative had more occurrences of high flows lasting more than five weeks than Alternative 2a-m, it was rated higher because 2a-m had so many in the 10-12 week range. This ranking is based on the total number of times that moving weekly average flows exceeded 4500 cfs for six or more weeks.

Table 5.5

Critical Period: During the critical spawning period (Table 5-6), Alternatives 4, 2a-m, 1bS2 and 1bS2-m all performed close to the same with fewest number of mean monthly flows >2800 cfs. Alternatives 1bS2 and 1bS2-M performed the best for flows in the preferred range (73).

Table 5.6

5.5.3. EVERGLADES AGRICULTURE AREA

Under any of the alternatives, regulatory discharges from Lake Okeechobee will be confined to existing canal systems and flow through the EAA without impacting agricultural fields or remnant wetlands where wildlife may occur. Although canal stages may be slightly higher at certain times of the year, this is not expected to be at any level that may affect existing fish and wildlife habitat.

5.5.4. WATER CONSERVATION AREAS (GREATER EVERGLADES)

For impact discussion on fish and wildlife resources, refer to Section 5.2.4.

5.6. ESSENTIAL FISH HABITAT ASSESSMENT

5.6.1. PROPOSED ACTION, 1BS2-M

In addition to this section, further evaluation of estuary effects for the Preferred Alternative can be found in Sections 4.2.2 and 4.5.2.

Excess storm water that is discharged from Lake Okeechobee to the Atlantic Ocean through the St. Lucie Canal can be very damaging to the St. Lucie Estuary, and to a lesser extent the IRL Estuary. Likewise, excess stormwater discharges to the Gulf of Mexico through the Caloosahatchee River can be damaging to the Caloosahatchee Estuary.

The proposed action, Alternative 1bS2-m regulation schedule, will reduce the amount of high flows to the St. Lucie Estuary, thereby reducing the frequency and severity of flushing events, algal blooms, turbid water and fish kills. Although improvements are not substantial, improved conditions for sensitive estuarine biota, such as species dependent on this habitat for egg, larval, and juvenile stages, may be seen. The Preferred Alternative will reduce the number of flows >2000 cfs from Lake Okeechobee to the St. Lucie Estuary. This reduction in high regulatory flows may provide improvement for the St. Lucie Estuary. Improved conditions within estuarine communities may result in improvements to SAV, oysters, fish, such as redfish, grouper, snook and spotted seatrout, and other fauna in the estuary.

Based on the information provided in this SEIS, the Corps has determined that the proposed operational changes to the water regulation schedule would have no anticipated adverse impact in the St. Lucie Estuary, and conditions may improve slightly with implementation of the Alternative 1bS2-m schedule.

The modeling results for the Caloosahatchee Estuary are somewhat mixed. The proposed action, Alternative 1bS2-m, improves mean monthly flows to the Caloosahatchee Estuary in the preferred cfs range of 450 cfs to 2800 cfs by 54 percent. Modeling simulations also indicated improvements in reducing mean monthly flows between 2800 cfs and 4500 cfs. Mean monthly flows in this range can cause adverse impacts to marine seagrasess and other organisms near the mouth of the Caloosahatchee Estuary. This flow range was reduced by ten months under the Preferred Alternative.

However, modeling simulations indicate no improvements in the high flow >4500 cfs range to the estuary. The Preferred Alternative allows a base flow to the Caloosahatchee Estuary during dry periods in order to meet low salinity conditions for SAV, primarily tape grass. This is a positive effect, and not a component built into the current WSE regulation schedule.

Based on the information provided in this SEIS, the Corps has determined that the proposed operational changes to the water regulation schedule would provide some benefits to the Caloosahatchee Estuary, particularly for flows in the preferred salinity range, reducing damaging flows between 2800-4500 cfs, and adding a base flow during dry periods. Even though some benefits for the Caloosahatchee Estuary would occur as described above, due to the increase in high flows >4500 cfs, the Corps has determined that the proposed action would provide minimal benefits overall to essential fish habitat in the Caloosahatchee Estuary.

5.6.2. ALTERNATIVES 1BS2, 2A, 2A-M, AND 4.

Refer to discussions in Section 4.2.2 and 4.5.2.

5.7. HISTORIC PROPERTIES

Historic properties would not be affected by any of the alternatives.

5.8. SOCIO-ECONOMIC

The following discussion of socio-economic existing conditions focuses on the principal social and economic forces of the Lake Okeechobee region. They include: commercial navigation via the Okeechobee Waterway, agriculture in the area immediately surrounding the lake, urban municipalities, recreation and sport fishing, and commercial fishing. More detailed information on the socio-economic conditions within the study area are presented in Appendix D.

Commercial Navigation

The Lake Okeechobee Waterway connects Stuart on the Atlantic Ocean with Ft. Meyers on the Gulf of Mexico. It includes 154 miles of navigation channel and five lock and dam structures. The Port Mayaca and Moore Haven locks connect Lake Okeechobee to the St. Lucie Canal and Caloosahatchee River respectively. Commercial navigation on this waterway has been stable over the past ten years, with sustained year to year variation (USACE 1998). The Lake Okeechobee Waterway was used to transport 430,000 tons of freight in 1995. Petroleum products were the predominant commodities transported (USACE 1998). There are no commercial shipping lines that regularly pass through the waterway, rather traffic consists primarily of special barge traffic which takes advantage of the shortcut across the Florida peninsula, saving about three to five days of travel.

Agriculture

The immediate area surrounding Lake Okeechobee is largely rural, with agriculture being critical to the local and regional economy. There are estimated to be over 700,000 irrigated acres of farm land in the LOSA, which includes the EAA. The EAA alone, accounted for over $750 million in agricultural production, and provided employment for over 20,000 full time workers in 1989 (Snyder and Davidson, 1994). Agricultural production consists predominantly of sugarcane, as well as rice, row crops, and sod. There is also extensive improved and unimproved pastureland, particularly west and north of Lake Okeechobee. The St. Lucie and Caloosahatchee basins, which also receive irrigation water from the lake, also contain an estimated 138,000 and 49,000 acres, respectively of citrus crops, sugarcane, vegetables, sod, and ornamentals (USACE 1998). During prolonged droughts, significant volumes of water are required by the agricultural community in the LEC. Row crops such as truck vegetables, are the predominant crop type in the LEC.

Urban

The urban landscape surrounding Lake Okeechobee includes the incorporated municipalities of Belle Glade, Clewiston, Moore Haven, Okeechobee City, Pahokee, and South Bay. These communities range in population from approximately 1,635 (Moore Haven) to 14,906 (Belle Glade). Residential and commercial water users depend on Lake Okeechobee's water supply for well field recharge, drinking water, and industrial processes.

In addition to the area immediately surrounding the lake, the populations of the Caloosahatchee and St. Lucie Basins, and of the LEC, can be affected by Lake Okeechobee operations. The 2000 population of the affected 16 county region was approximately 8.5 million. The combined population of these areas, along with the rural areas adjacent to the lake, accounts for just under 40 percent of the State's population. The economy of South Florida is based on services, agriculture, and tourism. The LEC

counties' economies are strongly oriented to the services industry, while the counties surrounding Lake Okeechobee are heavily agricultural.

Recreation and Sport Fishing

Lake Okeechobee is the largest recreational resource in the region and provides a wide variety of water based recreation including fishing, boating, picnicking, sightseeing, camping, swimming, hunting, airboating, and hiking. The littoral zone, along the lake's western shore, provides valuable habitat for the lake's popular sport fishery. Lake Okeechobee is recognized as supporting one of the best recreational fisheries in the nation. A variety and abundance of sport fish, including largemouth bass, black crappie, bluegill, and redear sunfish are targeted by sport fishermen from around the country. Consequently, sport fishing is a major activity on the lake. There is also several major sport fishing tournaments held on Lake Okeechobee annually, which bring significant revenues to the marinas, fishing guides, hotels, and support industries along the lake. It should be noted that Lake Okeechobee supports several commercial finfishing endeavors, including fisheries for bullhead catfish, gizzard shad, striped mullet (*Mugilcephcalus*), and gar (*Lepisosteus spp*).

Heavy seasonal waterfowl utilization of the lake attracts tourists and recreational enthusiasts, such as hunters. Common waterfowl species include ring-necked duck (*Aythya collaris*), American wigeon (*Anas americana*), Northern pintail (*Anas acuta*), green-winged teal (*Anas crecca*), blue-winged teal (Anas discors), lesser scaup (*Aythya affinis*), and Florida duck (*Anas fulvigula*).

Lake Okeechobee has been a historic tourist destination for purely aesthetic reasons. Airboat rides are popular tourist activities on the lake. Recreation levels in 1996 at Lake Okeechobee were estimated at over 64,000 visitor-hours, with an annual value of over $78,000,000 (USACE 1998).

Commercial Fishing

The commercial fishing industry in Lake Okeechobee utilizes primarily haul seines to catch bluegill, redear sunfish, and catfish. Catfish are also caught by trot lines, and wire traps. Bullhead, shad, gar, mullet, and tilapia are also caught, although since the net ban, mullet are no longer considered a commercial species. There are reports of commercial mullet trapping on the lake, mostly in the canals (FFWCC pexs. corn.). The annual wholesale value of the commercial fishery was estimated in 1998 (USACE) to be approximately $2,326,932, employing about 210 fisherman and landside workers.

There are also commercial fisheries on Lake Okeechobee, which harvest the American alligator and the Florida soft-shell turtle (Diemer and Moler, 1995). Alligators are harvested from the lake population to supplement the stock in alligator tanning operations. Soft-shell turtles are harvested by commercial fishermen, with some individual yields in excess of 13,640 kilograms (30,000 pounds) annually. The majority

of the harvest is prepared for shipment to Japan, or sold locally, primarily to the Miccosukee Tribe of Indians of Florida.

Land Use

The following section will address the general land use within the vicinity of Lake Okeechobee. The area is rural in character with most lands dedicated to agriculture. In general, sugar cane is the predominant crop in the south, row crops and sugar cane in the east, and pastureland with dairy production in the north. Urban areas, which are generally few and modest in population, service the agriculture sector, as well as the tourists who come to the lake to fish, hunt, and enjoy other recreational pursuits.

Agriculture

There is an abundance of agricultural lands surrounding Lake Okeechobee and throughout the affected area. The section below discusses the existing agricultural conditions by physiographic region, beginning with the largest area, the EAA, immediately south and east of the lake.

Everglades Agricultural Area

More than 600,000 acres are farmed in Palm Beach County (UFBEBR, 1995), and sugarcane was harvested in about half of that acreage in 1996 (FASS, 1996d). Much of this acreage is likely categorized as unique farmland based upon its location, growing season, and high value crops, including sugarcane and vegetables. Sugarcane receipts accounted for 68 percent of total field crop sales in Florida in 1996 (FASS, 1996c). The EAA is known for its sugarcane production and sugar processing, but Palm Beach County also ranks 15th among Florida counties for acres of citrus PASS, 1996b). This region is characterized by mid-size farms averaging 690 acres each with high productivity of more than $1300 per acre (UFBEBR, 1995). More than 18,000 people are employed in agricultural production and services representing a payroll of more than $26 million (UFBEBR, 1995). Total market value of agricultural products in Palm Beach County is approximately $900 million, ranking it first among counties in the State of Florida (UFBEBR, 1995) and third among U.S. counties (FDACS, 1994).

The EAA is highly dependent upon the system of canals running through the region to provide necessary drainage of excess water during the wet season as well as supplemental water supplies for irrigation during the dry season. Approximately two thirds of the land farmed in the EAA is irrigated, totaling more than 400,000 acres (UFBEBR, 1995). The EAA has traditionally relied upon Lake Okeechobee for its water supply during drier periods, and looked to the WCAs to the south to receive their excess drainage.

Continued agricultural production in the EAA has become increasingly controversial. Some of the factors that may affect the EAA agriculture include water quality concerns, soil subsidence, and urban encroachment. The water quality concerns, particularly

phosphorus loading, are being addressed through best management practices, STAs, and growing use of organic farming practices and rice cultivation in rotation with sugarcane production. Although sugarcane cultivation in the EAA has come under some sharp criticism in recent years, sugarcane is recognized as the most appropriate crop for this region. Sugarcane requires less phosphorus fertilizer than other crops grown in the EAA (Sanchez, 1990), and sugarcane has been found to remove 1-79 times more phosphorus than was applied as fertilizer (Coale et al., 1993). Florida sugarcane only requires small amounts of pesticides due to disease resistant and tolerant cultivars, and uses cultivation instead of herbicides for weed control. Sugarcane also tolerates greater variability in water table levels, allowing for more flexible water management strategies (Glaz, 1995).

Soil subsidence has become a potential threat to long-term crop production in the EAA. The average historic rate of subsidence of one inch per year has slowed to 0.56 inches per year since 1978 (Shih et al., 1997). The lower rate was attributed to several factors including higher water tables and an increased proportion of land planted to sugarcane. Surveys conducted by Shih et al. (1997) found an average of 1.62 feet to 4.36 feet of soil remaining over I1 transects. Prevention of continued soil subsidence will depend on maintaining high ground water levels to prevent further oxidation of the soil profile. This, in turn, will require development of more water-tolerant sugarcane varieties and/or increased rice cultivation. This research is currently underway and showing promising results (Glaz, 1997). A strong agricultural economy in the EAA based on profitable crop production is the best defense against conversion of agricultural land to urban land.

Kissimmee River Basin

Immediately north of Lake Okeechobee, Osceola, Polk, Highlands, and Okeechobee Counties surround the Kissimmee River Basin. More than two million acres in these counties are farmed, with more than half of this area devoted to pastureland (UFBEBR, 1995). Much of this acreage is likely categorized as unique farmland based upon its location, growing season, and high value crops, including citrus. Approximately a quarter of a million acres in the Kissimmee River Basin are irrigated (UFBEBR, 19951), requiring a dependable water supply. This region is characterized by large farms with relatively low productivity per acre. These four counties are among the top five counties in Florida for cattle production, both beef and dairy (FASS, 1996a). More than 200,000 acres are used for citrus production. Approximately 11,000 people are employed in agricultural production and services representing a payroll of approximately $21 million. The market value of all agricultural products in this region totals approximately $575 million (UFBEBR, 1995).

Martin and St. Lucie Counties (Upper East Coast)

At present, the dominant land use in the basin is agriculture (covering approximately 45 percent of the basin). Agricultural activities include 228,000 acres of citrus, 211,000 acres in range and citrus, and 9,500 acres of vegetable crops (SCS, 1994). The present urban land use (17 percent of the basin) is concentrated along the coast and

the lagoon shorelines. Urban growth is rapidly extending westward, replacing agricultural land. Future land use patterns indicate that this trend will continue as urbanization intensifies along the coast, especially in the southern counties (Swain and Bolohassen, 1987). Present forested uplands and wetlands comprise 11 and 18.8 percent of the basin, respectively.

Caloosahatchee River Basin

Approximately one half million acres are farmed in the Caloosahatchee River Basin, and approximately three-fourths of that area is pastureland. The region is characterized by large farms averaging 1,800 acres, with relatively low productivity per acre (UFBEBR, 1995). Glades County ranks eighth in the State of Florida for cattle production (FASS, 1996a). Citrus production in the Caloosahatchee River Basin covers more than 20,000 acres (FASS, 1996b) and is currently increasing. Much of this acreage is likely categorized as unique farmland based upon its location, growing season, and high value citrus crops. Approximately 5,000 people are employed in agricultural production and services, and the payroll totals approximately $5 million. Agricultural products in this region have a total market value of more than $135 million (UFBEBR, 1995).

More than 77,000 acres of farmland are irrigated in the Caloosahatchee River Basin (UFBEBR, 1995). Reliable water supply is a big concern in this region which has traditionally relied upon water deliveries through the Caloosahatchee River from Lake Okeechobee. Irrigation demands can be expected to increase as additional land is used for citrus production.

Urban Land Use

A significant use of land outside the agricultural context is for urban development. Six incorporated communities are situated around the lake and range in population from approximately 1,400 to 16,000.

Table 5.7

The Brighton Seminole Indian Reservation occupies a large area of land west of Lake Okeechobee in Glades County. The southern end of this reservation is near the HHD just north of Lakeport. Major transportation corridors around the perimeter of Lake Okeechobee Include several highways and railroads. County Road (CR) 78 parallels the lake along its western and northern shores from Moore Haven to Okeechobee.

From Okeechobee, State Highway 98 follows the northern and eastern portion of the lake to Pahokee. CR 715 then follows the HHD from Pahokee to Belle Glade, where State Highway 27 follows the southern lake area back to Moore Haven and CR 78.

The municipalities of Stuart at the mouth of the St. Lucie Estuary, Fort Pierce, to the north of Stuart, and Jupiter to the south, are the three principal urban centers nearest the outlet of the C-44 within Martin and St. Lucie Counties.

On the west side of the lake, along the Caloosahatchee River and on Charlotte Harbor, urban areas include the cities of LaBelle, Alva, Olga, Fort Myers, and Cape Coral. Land use adjacent to the Caloosahatchee Estuary is largely residential and urban with the city of Cape Coral on its northern bank and the highly urbanized City of Fort Myers on its south bank. Both of these communities have experienced rapid growth with even more growth anticipated in the near future (SFWMD, 1997).

Recreation Resources

Recreation resources in the Lake Okeechobee region are primarily water based within Lake Okeechobee and include boating, fishing, and nature interpretation. Lake Okeechobee provides approximately 40 miles of navigable waterway for commercial navigation and many more for recreational boating. Twenty-five USACE built land and water-based recreational facilities are located along the lake. The Florida National Scenic Trail encompasses Lake Okeechobee atop the HHD (approximately 140 miles long). Approximately 94 percent of the recreation lands available to the public in this region are owned by the State or Federal government (SCOW, 1994). Bike riding, hiking, picnicking, camping, and nature interpretation are popular land based recreation activities in the region. Substantially altered water deliveries to this region could result in flooding and have a detrimental affect on many natural and recreation resources in the area. The ample water based recreation resources in the Lake Okeechobee region receive extensive use and future demand is anticipated to increase. The St. Lucie Canal provides approximately 34 miles of navigable waterway with four USACE/County recreation facilities that include boating, fishing, camping and day use facilities (USACE, 1991). The approximately 44 miles of Intracoastal Waterway, within the Upper East Coast, provides many coastal recreational navigation opportunities.

Public beaches in the Upper East Coast are the most popular forms of recreation in the region. Four State of Florida Aquatic Preserves, and four State Parks and Recreation Areas are within the Upper East Coast. Five artificial coastal reefs provide popular diving and fishing spots. The region also includes high quality recreation opportunities within the Dupuis Reserve State Forest and Wildlife and Environmental Area and the St. Lucie Inlet Preserve. Overall, existing recreation resources in the region receive heavy annual usage that is expected to increase in the future.

Recreation resources in the WCA region are inland water and upland resources that include the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and Rotenberger and Holey Land WMAs (SCOW, 2000). These areas provide high quality boating, fishing, and nature interpretation activities. The Miccosukee State Indian Reservation is within the WCA region boundary. Hunting, boating, and fishing occur within the Everglades WMA, including the Miccosukee State Indian Reservation.

The Caloosahatchee River provides approximately 67 miles of navigable waterway with ten Corps recreation facilities that include boating, fishing, picnicking, and camping. The J.N. “Ding” Darling National Wildlife Refuge, a popular birding area, administers Caloosahatchee, Matlacha Pass, Island Bay National Wilderness area and Pine Island National Wildlife Refuge, all located near the region’s western edge. Boca Grande Pass is world renowned for record tarpon, and Sanibel and Captiva Islands are reported among the top shelling destinations in the Western Hemisphere.

Caloosahatchee State Park and Recreation Area is located near Alva on the Caloosahatchee River. Estero River and Hickory Creek State Canoe Trails are within the region and provide excellent recreation resources. Cayo Costa State Park, Sanibel Island State Park, and State Aquatic Preserves are located in the region.

5.9. AESTHETICS

Aesthetics within the study area will probably not be affected in the short-term. Since there will not be any structural modifications to the existing operations system, no visible impediments to existing landscapes will be present. While plant communities may change over time through varying water management practices, succession, and competition, among other factors, significant (observable) changes to plant communities *usually* require a few to several years to occur. Over the longer term, improved hydroperiods within Lake Okeechobee and the St. Lucie Estuary are expected to benefit native plant communities which should support enhanced numbers of native fish and wildlife. A reduction in the occurrence of prolonged and extreme high lake stages within Lake Okeechobee for instance should reduce excessive turbidity, and enhance wading and foraging conditions and nesting success for wading birds, two components of the ecosystem which contribute greatly to the visual aesthetic/appeal. Healthier seagrass beds in the St. Lucie and IRL will provide better habitat for fish stocks which, although not easily seen by the casual observer, also act as food sources and support bald eagles and other fish eating raptors whose presence may enhance the wilderness aesthetic of the estuary.

There are not expected to be any affects on existing or future aesthetics within the EAA, nor to the Caloosahatchee River. Neither area benefit greatly from the proposed action in terms of improved hydroperiods and flows through these areas will not affect related resources, existing land use or other variables that may enhance or detract from current appearances.

5.10. RECREATION

Improvements to Lake Okeechobee's hydroperiod should reduce the occurrence of prolonged high lake stage events in particular, that have adversely impacted native aquatic and marsh vegetation around the lake over the past several years. The littoral and marsh habitat provides important nesting, breeding and feeding areas for fish and wildlife and the health and sustainability of these vegetation communities is crucial to the recreation resources, particularly fishing, hunting, and wildlife viewing. The Preferred Alternative (1bS2-m), by allowing for lower lake levels, would protect and enhance fish and wildlife habitat within Lake Okeechobee, to a certain degree, by reducing over inundation of emergent and floating vegetation and improving light penetration to SAV, components of which are important habitat throughout the life cycle of fishes, wading birds, raptors, waterfowl, and other animals which make up the food chain. Moreover, lower lake levels may also contribute to a reduction in sediment and nutrient transport into the back water marsh areas and littoral zone and reduce resuspension of nutrients which contribute to algae bloom production. These improvements to hydroperiod, aquatic vegetation, and water quality should translate into better opportunities for fish and wildlife reproduction, foraging and cover, and allow for larger, more sustainable populations for fishing, hunting, and wildlife observation.

The slightly reduced freshwater flows >2000 cfs to the St. Lucie Estuary in particular may improve fish and wildlife habitat and improve conditions for the fishery. Although high regulatory releases would still be necessary on occasion, the reduced volume of lake water sent to the estuary would improve overall salinity regimes, water clarity and color, reduce turbidity and probably reduce the oxygen demand of deposited silts. Any conditions which favor growth and expansion of seagrasses and improved water quality, will enhance the fishery and opportunities for commercial and sport fishing. Wildlife viewing may also be enhanced with healthy and sustainable seagrass beds. Habitat for prey species such as invertebrates and forage fishes which are food sources for eagles, wading birds, marine mammals and other watchable species will enhance opportunities to view these animals. Manatees, which feed directly on seagrasses will also benefit through improved conditions for their primary food source

All of the proposed alternatives, including 1bS2-m, would have more occurrences of low water stages, and extreme low water stages, than the WSE schedule. Low water events would impact recreational boat users navigating Lake Okeechobee, and accessing the lake from local boat ramps. Some boat ramps and marinas may be inaccessible during low water events below >11 feet.

5.11. NAVIGATION

Boating access to Lake Okeechobee is affected by water levels. At lake stages below 12.56 ft., NGVD, the authorized project depth cannot be maintained. During low lake level, navigational access to much of the fishing area is reduced. The rim canal and boat trails also become inaccessible during low water periods. Boat ramp access and marina access is also impacted in certain areas around Lake Okeechobee when water levels fall below 12 feet. Table 5-8 below gives lake conditions at a glance for Route 1.

Table 5.8

The hydrologic PM used for navigation was based on the 1965-2000 simulation POR. The performance of each alternative was measured by the number of times in the POR that lake stage is below 12.56 feet (Table 5-9). In summary, all of the alternatives performed worse than the base for days below 12.56 feet. Adverse effects to navigation would occur under any alternative, including the preferred Alternative 1bS2-m.

Table 5.9

5.12. COASTAL BARRIER RESOURCES

There are no coastal barrier resources located in the project area.

5.13. WATER SUPPLY

The water supply performance measures used in the LORSS are located in Table 5-10. The Preferred Alternative, 1bS2-m, allows for the water supply requirements to be satisfied nearly as effectively as the current operational schedule, WSE. Alternative 1bS2 performs close to the Preferred Alternative. The performance of Alternatives 2a and 4 are close and show minor effects compared to the No Action Alternative. Alternative 2a-m would indicate more minor effects with respect to water supply than the other alternatives.

5.14. FLOOD PROTECTION

One of the goals of the LORSS is to reduce the frequency of high lake stages that may be stressful to the HHD levee system surrounding Lake Okeechobee, which provides flood protection for the surrounding area. Lake Okeechobee water levels are managed to minimize risks for each hurricane season. Because the Corps recognizes that the HHD is more stable when water in Lake Okeechobee is maintained below 18.5 feet, the LORSS only focused on alternatives that would allow the lake to be managed at a lower average level year-round. The final array of alternatives analyzed were developed to achieve zero or close-to-zero days above lake elevation 17.25 feet, NGVD. Any alternative not meeting the high lake constraint of 17.25 feet, NGVD was eliminated from further analysis in the SEIS. The 17.25 feet constraint was based on the schedule's ability to store rainfall and runoff anticipated from a storm event comparable to Hurricane Wilma in 2005 without having HHD integrity issues.

The Corps evaluated all alternatives that included lake elevations beginning at 16 feet, NGVD to 17.25 feet, NGVD (Figure 5-9). Evaluating stage elevation at and above 16 feet, NGVD, allowed consideration of the trends in duration of days within this high lake band. Based on this evaluation, Alternatives 2a and 2a-m performed the best, followed by Alternatives 1bS2, 1bS2-m and 4. The No Action (WSE) alternative was the least effective at maintaining lower lake levels.

Table 5.10

5.15. WATER QUALITY

The Corps has engaged FDEP (K. Shugar, personal communication, July 2006) in discussions on the Lake's TMDL and the proposed water management change for the Lake to ensure that there is no conflict between our water management change and the TMDL goals set forth in the FDEP TMDL. This discussion will be on-going. It is not anticipated that the Preferred Alternative will have an adverse effect on TMDL goals for the lake. If the littoral zone vegetation rebounds from damages experienced from the 2004 and 2005 hurricane seasons, the vegetation may actually assist in the attainment of TMDL goals set by FDEP.

No measurable impact to Lake Okeechobee water quality is anticipated from the proposed alternatives due to the limitations of operational only regulation schedule adjustments. There are minor positive effects to the St. Lucie Estuary due to the

reduction in the number of undesired high regulatory discharges from Lake Okeechobee under the Preferred Alternative. The Caloosahatchee River and Estuary will have more discharges in the optimum flow range (450-2800 cfs) as a result of the new schedule. The model results also indicate very minor increases of heavy discharges. Additionally, there are very minor adverse effects from any alternative to the receiving marsh areas in the WCAs. These are primarily due to the STAs water quality treatment capacity (currently 64,000 acre-feet annual average, based on a lake water phosphorus level) constraint on regulatory discharges from Lake Okeechobee to the WCAs. As phosphorus levels decline in the lake more water can be treated in these STAs and delivered south to the WCAs.

5.16. HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

A preliminary assessment indicated no evidence of HTRW affecting this action

5.17. AIR QUALITY

Air quality would not be impacted by any of the alternatives.

5.18. NOISE

With implementation of any of the alternatives, there would be no affect on existing or future noise levels.

5.19. PUBLIC SAFETY

Public health and safety was a major factor in the development of the alternatives. One of the goals of the LORSS is to reduce the frequency of high lake stages. Florida has experienced back to back active hurricane seasons during the last two years, which produced significant rain and raised lake elevations. Lake Okeechobee water levels are managed to minimize risks for each hurricane season. The LORSS only focused on alternatives that would allow Lake Okeechobee to be managed at a lower average level year-round. The final array of alternatives were developed to achieve zero or close-to-zero days above lake elevation 17.25 ft., NGVD. Any alternative not meeting the high lake constraint of 17.25 ft., NGVD was eliminated from further analysis in the SEIS.

The Corps only evaluated alternatives with maximum high lake stages beginning at 16 ft., NGVD to 17.25 ft., NGVD (Figure 5-10). Evaluating stage elevation at and above 16 ft., NGVD allowed consideration of the trends in duration of days within this high lake band. Based on this evaluation, Alternatives 2a and 2a-m performed the best, followed by Alternatives 1bS2, 1bS2-m and 4. The No Action (WSE) alternative had the poorest performance.

Figure 5.10

5.20. NATIVE AMERICANS

There would be no impact to Native American resources.

5.21. DRINKING WATER

Implementation of any of the alternatives would not adversely impact drinking water consumption for the surrounding communities.

5.22. CUMULATIVE EFFECTS

Cumulative impacts are impacts likely to occur due to the proposed action or alternatives in combination with other past, present and reasonably foreseeable future actions. As stated previously, this study has been designed to identify a lake regulation schedule which would be in effect until a more comprehensive solution to the water regulation and management challenges is implemented by the CERP. A key feature to restoring the lake and the estuaries under the CERP is the construction of several large storage reservoirs, reservoir assisted STAs and STAs which would attenuate and treat flows to the lake and downstream receiving water bodies. These are the type of structural features which will likely be necessary to fully resolve the environmental problems inherent in the present system.

5.23. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.23.1. IRREVERSIBLE

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment might be the mining of a mineral resource. As there are no proposed construction activities or alteration of existing features or landscape, there should be no irreversible commitment of resources as a result of this action.

5.23.2. IRRETRIEVABLE

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction. As there are no proposed construction activities or alteration of existing features or landscape, there should be no irreversible commitment of resources as a result of this action.

5.24. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

As the proposed action is completely operational, and does not contain any physical features, construction, or addition or removal of structures, and the action is designed to enhance conditions to the natural environment, there are minimal adverse effects anticipated to the natural and human environment.

Conditions within the Caloosahatchee Estuary are not predicted to be improved substantially. Although the Preferred Alternative increased the mean monthly flows >4500 cfs by 3 months, it did reduce the flows between 2800 cfs and 4500 cfs by 10 months. Flow range >2800 can be significantly damaging to the estuary. On the more positive side, the number of mean monthly flows in the preferred range of 450 cfs to 2800 cfs increased by 85 months over the WSE schedule. The number of months in the SFWMM simulation POR is 432.

5.25. COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

Alternatives evaluated are compatible with Federal, State, and local objectives.

5.26. CONFLICTS AND CONTROVERSY

There will always be a level of controversy with any issue related to water management is south Florida. Few issues remain unresolved with various commenting agencies and other non-governmental groups. However, stakeholder input obtained during the

Planning phase of the study indicates much concern over the health of the Caloosahatchee Estuary. Stakeholders representing the Caloosahatchee Estuary have concerns that the alternatives analyzed show minimal benefits for the estuary. As described in section 4.24, conditions in the Caloosahatchee Estuary are not predicted to improve substantially. However, modeling simulations indicated slight improvement in the preferred flow range, and improvements in reducing mean monthly flows between 2800 cfs and 4500 cfs. Mean monthly flows in this range may cause adverse impacts to marine seagrasess and other organisms near the mouth of the Caloosahatchee Estuary. This flow range was reduced by 10 months under the Preferred Alternative.

5.27. ENVIRONMENTAL COMMITMENTS

The Corps will continue consulting with scientists during weekly operations meetings to determine the status of the individual ecosystems in the study area. Spring season is critical for all ecosystems in the area. Allowing spring recessions in the lake with limited reversals is critical to plants and animals, including nesting and foraging habitat for the endangered snail kite. Additionally, springtime is critical for the estuaries. So, maintaining certain flow ranges for the salinity envelopes is desirable during lake discharges.

5.28. COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

5.28.1. NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

Environmental information on the action has been compiled and this draft SEIS has been prepared. The project is in compliance with the NEPA.

5.28.2. ENDANGERED SPECIES ACT OF 1973

A species list was requested from NMFS on September 15, 2005. No threatened or endangered species under the jurisdiction of NMFS would be affected by this action. A species list was requested from USFWS on August 29, 2005, and received on September 30, 2005. Informal consultation was initiated with USFWS by letter dated March 8, 2006. Formal consultation was initiated with USFWS by letter dated June 30, 2006, which included a Biological Assessment of effects on endangered and threatened species. This action will be fully coordinated under the Endangered Species Act and will be in full compliance with the Act.

5.28.3. FISH AND WILDLIFE COORDINATION ACT of 1958

This action has been coordinated with the U.S. Fish and Wildlife Service (USFWS). A Coordination Act Report (CAR) is forthcoming from the USFWS. This project will be in full compliance with the Act.

5.28.4. NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA)

The action is in compliance with the act.

5.28.5. CLEAN WATER ACT OF 1972

The proposed action is in compliance with this act. As the proposed action is strictly of an operational nature, and does not involve any construction activity, water quality

certification from the State of Florida is not required. Furthermore, as there are no structural components contained in the proposed action and no dredge and fill operations being considered, a Section 404(b) Evaluation is not appropriate.

5.28.6. CLEAN AIR ACT OF 1972

No air quality permits will be required for this action.

5.28.7. COASTAL ZONE MANAGEMENT ACT OF 1972

A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as *Appendix B*. State consistency review will be performed during the coordination of the draft EIS and the State will determine if the action is consistent with the Florida Coastal Zone Management (CZM) Program.

5.28.8. FARMLAND PROTECTION POLICY ACT OF 1981

No prime or unique farmland would be impacted by implementation of this action. This act is not applicable.

5.28.9. WILD AND SCENIC RIVER ACT OF 1968

The Northwest Fork of the Loxahatchee River is designated a Wild and Scenic River. This resource is not expected to be adversely impacted by the proposed action. The study is in full compliance with this act.

5.28.10. MARINE MAMMAL PROTECTION ACT OF 1972

The proposed action is operational and does not involve construction activities; there would not be any adverse impact to marine mammals in the area. Therefore, this action is in compliance with the Act.

5.28.11. ESTUARY PROTECTION ACT OF 1968

The IRL and Charlotte Harbor are part of the National Estuary Program established by Section 320 of the Clean Water Act. This action would not adversely affect these estuaries. As such, the action is in compliance with this Act.

5.28.12. FEDERAL WATER PROJECT RECREATION ACT

The effects of the proposed action on outdoor recreation have been considered. Benefits to fishing, boating and wildlife viewing should be accrued by implementation of the proposed action. Therefore, the action is in compliance with this act.

5.28.13. FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

This action is being coordinated with the National Marine Fisheries Service (NMFS) and will be in compliance with the act.

5.28.14. SUBMERGED LANDS ACT OF 1953

The action would occur on submerged lands of the State of Florida. The project has been coordinated with the State and is in compliance with the act.

5.28.15. COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources in the project area that would be affected by this action. These acts are not applicable

5.28.16. RIVERS AND HARBORS ACT OF 1899

The proposed action will not obstruct navigable waters of the United States. The action is in full compliance.

5.28.17. ANADROMOUS FISH CONSERVATION ACT

Anadromous fish species will not be affected. The action has been coordinated with the NMFS and is in compliance with the act.

5.28.18. MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

No migratory birds will be affected by the action. The action is in compliance with these acts.

5.28.19. MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

The term "dumping" as defined in the Act (3[33 U.S.C. 1402](f)) does not apply to the action proposed. Therefore, the Marine Protection, Research and Sanctuaries Act does not apply to this action.

5.28.20. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

This act requires the preparation of an EFH Assessment and coordination with the NMFS. The EFH Assessment within the draft SEIS will be coordinated with the NMFS during the normal NEPA coordination process. This action is in compliance with the act.

5.28.21. E.O. 11990, PROTECTION OF WETLANDS

No wetlands will be affected by the action. This action is in compliance with the goals of this E.O.

5.28.22. E.O. 11988, FLOOD PLAIN MANAGEMENT

The project area is in the base flood plain (100-year flood) and has been evaluated in accordance with this E.O. The action is in compliance.

5.28.23. E.O. 12898, ENVIRONMENTAL JUSTICE

The proposed action will not result in adverse health or environmental effects. Any impacts of this action will not be disproportionate toward any minority. The activity does not (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. The activity would not impact “subsistence consumption of fish and wildlife”.

5.28.24. E.O. 13089, CORAL REEF PROTECTION

The proposed action will not result in adverse impacts to coral reef ecosystems. No coral reef habitats exist within or near the project area. This act is not applicable.

5.28.25. E.O. 13112, INVASIVE SPECIES

This action does not authorize, fund, or carry out action that might spread or introduce invasive species.